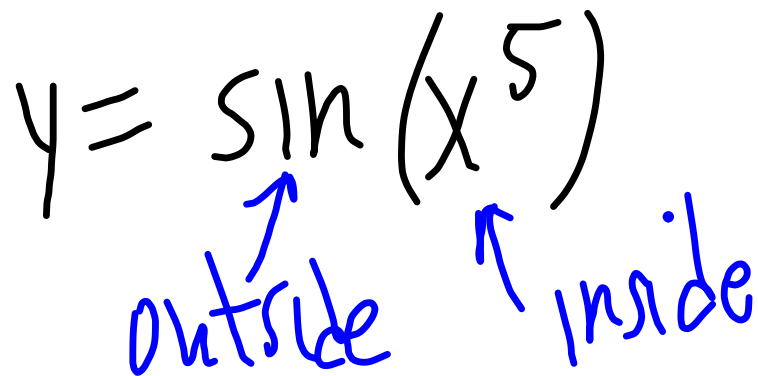


3.6 The mighty chain rule
used to take the derivative of
a composite function.

composite function:
function of a function

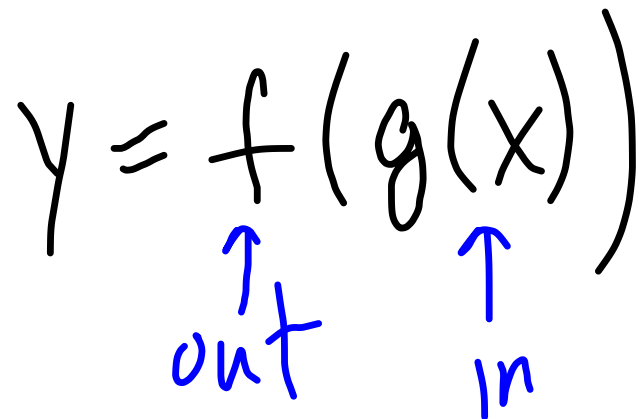
$$y = \sin(x^5)$$

outside inside



$$y = f(g(x))$$

out in



$$y = \tan(x^2 + 2x + 1)$$

$$y' = (2x + 2) \sec^2(x^2 + 2x + 1)$$

$$y = \sec^3 x = (\text{sec } x)^3$$

out

$$y' = \sec x \tan x \cdot 3(\sec x)^2$$

↑
in

outside: u^3

der: $3u^2$

$$y = (x^2 + 2x + 1)^7$$

$$y' = (2x+2) \left[7(x^2 + 2x + 1)^6 \right]$$

$$y = x^3 \cdot (x^2 + 2x + 1)^7$$

$$y' = 3x^2 \cdot (x^2 + 2x + 1)^7 + x^3 (2x+2) 7(x^2 + 2x + 1)^6$$

#149 chain rule

$$(f \circ g)'(x)$$

$y = f(g(x))$	$y' = g'(x) f'(g(x))$
---------------	-----------------------

$$u = g(x)$$
$$y = f(u)$$


$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

der
of out

der of
inside

• $y = \sin(x^5)$

$$y = \sin(u) \quad u = x^5$$

$$y' = 5x^4 \cos(x^5)$$


u

$$\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}$$